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The development of a research model to aid in the understanding of the hierarchical structure of reading readiness is described. Data were obtained by testing 218 first graders from three elementary schools with the Frostig Developmental Test of Visual Perception, the Gates Reading Readiness Test, the Metropolitan Readiness Test, the Olson Reading Readiness Tests, and the Wechsler Intelligence Scale for Children. The product moment method was used to compute the intercorrelations among the 35 variables. After an examination of the loading of the subtest variables, four large common factors, listed in order of increasing correlation with the factor best representing reading achievement, could be ordered as follows: (1) perceptual organization, (2) auditory-visual discrimination, (3) verbal association, and (4) verbal comprehension. Both a horizontal and a vertical plane were developed in this model. It is suggested that the order of the skills on the vertical plane would also develop horizontally and might or might not contribute to the achievement level of a higher order dependent upon the type of achievement measured. Questions for further investigation are posed, and references are included. (CM)

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IRA paper

THE STRUCTURE OF READING READINESS ABILITY

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The studies of reading behavior have for a number of years looked at, turned over and dissected the initial stages of learning to read with a maximum of confusion and a minimum of meaningful information. The research is full of conflicting research data and unfounded conclusions. Some types of research in reading readiness are probably exhausted but a new phase of investigation is just beginning.

The present paper deals with the development of a model to aid in the understanding of the structure of reading readiness. It is not intended as a teaching model but rather, a research model. It is an attempt to place previous research in proper perspective and to present the findings of a research study by Olson et al. (1968) which suggests the hierarchical order of skills.

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The purpose of the study by Olson, A. V.; Rosen, C.; Simpson, H.; Fitzgibbon, N.; and Rentz, R., (1968) was to investigate and identify the extent to which the

best combination of readiness tests were related to each other. The subjects (n = 218) included in the study were selected from three elementary schools representing nine first grade classrooms. The mean chronological age for the population was 6 years, 3 months with a standard deviation of 7 months. The mean verbal and non-verbal IQs were 92.47 and 98.14 respectively.

During the first month of school in the first grade the population was tested on the following instruments.

1. Frostig Developmental Test of Visual Perception (FDTVP), 1963
2. Gates Reading Readiness Test (GRRT), 1939
3. Metropolitan Readiness Test (MRT), 1950
4. Olson Reading Readiness Tests (ORRT), 1967
5. Wechsler Intelligence Scale for Children (WISC), 1949

The product moment method was used to compute the intercorrelations among the 35 variables. Unities were placed on the main diagonal of the resulting matrix.

To obtain the initial solution, the correlation matrix was factor analyzed by the principal axis method. To determine the number of factors to be retained for rotation, two criteria were considered; Kaiser (1958) and Cattell's Scree Test (Cattell, 1966). Six factors were extracted with eigenvalues greater than one (Kaiser, 1958), accounting for 63.2 percent of the total variance.

The Scree Test (Cattell, 1966) suggested a four factor solution, accounting for 56.7 percent of the variance. For interpretive purposes both the six factor and four factor solutions were rotated by the normal varimax procedure in an effort to achieve simple structure.

The rotated factor structure for the six factors revealed four large common factors and two smaller factors each loading only two variables. These two factors appeared rather unimportant, resulting in the retention of the four larger common factors for further analyses and interpretation. In order to obtain simple structure it was necessary to rotate the factors by an oblique procedure. Therefore, the four factors were rotated by the maxplane method.

After an examination of the loadings of the respective subtest variables, the four large common factors were labeled as follows:

Factor I - Auditory-Visual Discrimination

Factor II - Verbal Comprehension

Factor III - Perceptual Organization

Factor IV - Verbal Association

Table 1 shows the hyperplane counts obtained by the varimax, maxplane methods and the correlations among the oblique factors.

TABLE I

Factor Intercorrelations and Hyperplane Count Comparisons for the 35 Subtests

	Factors			
	I	II	III	IV
I	1.000			
II	.662	1.000		
III	.485	.395	1.000	
IV	.540	.716	.375	1.000
Varimax %	8.6	17.1	11.4	14.3
Maxplane %	40.0	48.6	57.1	51.4

In order to understand the characteristics of the four factors a brief discription of each is in order.

Factor I - Auditory-Visual Discrimination

The first factor designates the auditory-visual measures frequently associated with reading readiness. They measure the auditory-visual perceptual abilities of controlled association, orientation, visual-auditory memory, pattern completion and visual response to verbal stimuli. This factor supports the conclusions found by Goins (1958) and Sister Mary Nila (1953). There appears to be a unitary skill underlying the measures isolated in this factor which can be called auditory-visual discrimination.

Factor II - Verbal Comprehension

Factor II seems to reflect that aspect of verbal ability that has been learned. The tests found within this factor parallel closely the findings of Cohen (1959). Cohen in his analysis of the factor observed in children age 7-6, 10-6 and 13-6 hypothesized that the factor indicated "verbally retained knowledge impressed by formal education." The age group studied for the population of this study would seem to indicate that the verbal ability identified by this factor may also be learned informally before the child is exposed to much formal education.

Factor III - Perceptual Organization

The tests which load this factor are essentially nonverbal (exception: rhyming) and require the interpretation and/or organization of visually perceived materials against a time limit. The three Frostig subtests found in this factor are identical to that found in a cononical analysis by Ohnmacht and Olson (1968) while the object assembly test is similar to the results found by Cohen (1959).

Factor IV - Verbal Association

The subtests which load on this factor seem to reflect the verbal association skills which are usually taught at the beginning of first grade. The distinguishing characteristic between Factor II and IV appears to be the knowledge and concomitant application of the knowledge impressed by formal education in Factor IV which is absent in Factor II.

It appears from the results of this study that there is enough evidence from the pattern of variable loadings in the factors and correlation among the factors to suggest a hierarchical order of skills. The pattern indicates that in order of increasing correlation with the factor best representing achievement in reading, the underlying skills could be ordered in the following manner: (1) perceptual organization, (2) auditory-visual discrimination, (3) verbal association and (4) verbal comprehension.

Researchers in reading have often asserted that reading ability can be conceptualized as a hierarchically organized set of skills. The assumption has been however, that the skills were in a systematic sequential order and developed on a somewhat horizontal plane. The results of this study and previous research study indicates that the skills probably develop on both a horizontal and vertical plane. The skills represented in the factor called perceptual organization may well be important for the child to master before he can progress to the next order of skills (auditory-visual discrimination). At the same time the perceptual organization skills of a higher order than those evaluated may be important in other types of reading achievement than those measured by the instruments in the study.

If a model could be generated it would probably consist of a series of skill areas in a hierarchical vertical order phasing out in the contribution the skill makes to reading achievement as the power of reading ability increases horizontally. The order of the skills on the vertical plane would also develop horizontally and may or may not contribute to the achievement level of a higher order dependent upon the type of achievement we are measuring. Put in another way, it might be hypothesized that the sequence of skills in a hierarchical order transfer in the horizontal sequence to higher orders of the skill that would change the sequence of skill factor dependent upon the type of achievement

identified. The use of global measures to identify the achievement level may be clouding the issue since the achievement tests may not be refined enough to allow for observation of the growth in skill sequence.

It seems to this investigator that several questions should be investigated based upon this model.

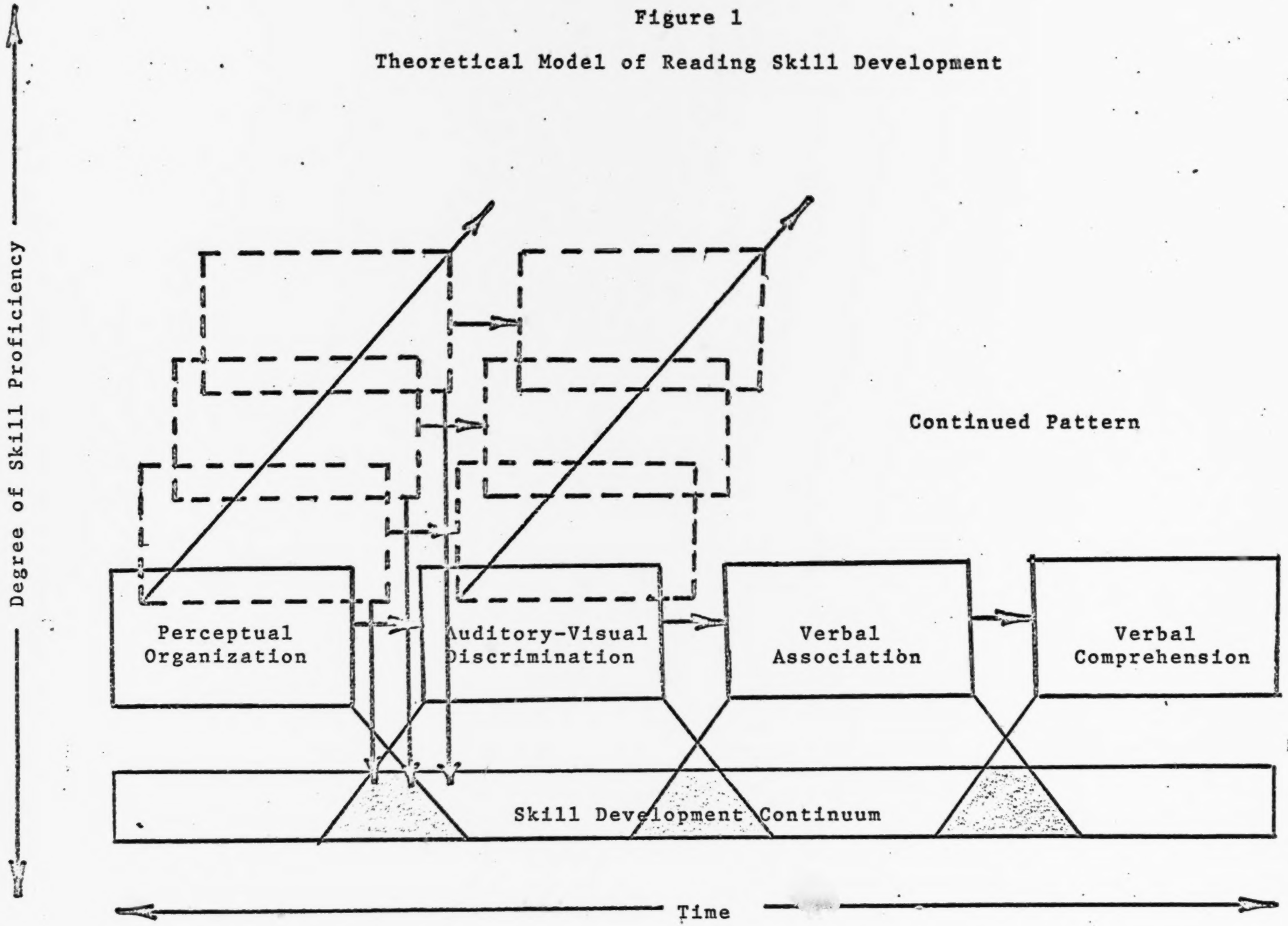
1. What degree of proficiency in skills does a student need to possess in order to progress from one level to the next?
2. At what rates do the specific skills develop based upon a number of variables?
3. Does the amount of skill development vary dependent upon the kind of achievement we are evaluating?
4. As the students grow in their development of reading skill does the relationship of the factors change and does the order change? (The answer to this question has been partially explored by Johnson (1968)).

The answer to these basic questions would need to be answered if any clear understanding of the reading process is to evolve.

Another implication of the finding is that intellectual factors are of primary importance in determining reading achievement. The Verbal Comprehension factor which comprises most of the verbal tests on the WISC seems

Figure 1

Theoretical Model of Reading Skill Development



to be the factor most closely related to achievement. The Verbal Association factor is next most highly related to achievement and appears to indicate skills and abilities learned in a school setting. It may well be that the most important characteristic of the child for evaluation in first grade is intellectual functioning and not specific skills. One implication of this study would seem to be that level of verbal functioning will determine the extent to which school acquired verbal comprehension skills will be developed.

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